

# INDOT Geotechnical Services Division Identifying Indiana Landslides



Photo: SR 145 Orange County, Indiana

## Introduction

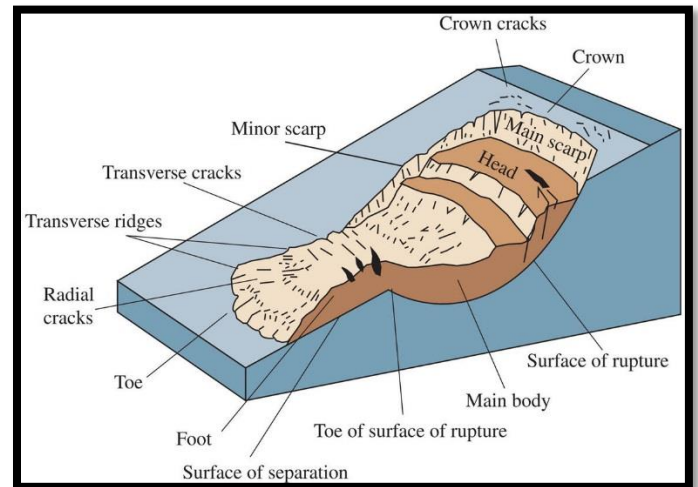
Landslides are downward or outward movement of slope forming-materials composed of soils, rocks, or a combination of these materials. Landslides can occur throughout the state of Indiana; however, they are most prevalent in the southern-half. Landslides sometimes occur within highway embankments and cut slopes throughout southern Indiana. Landslides that occur in the northern-half of the state are mostly related to stream bank failures. The level of damage to Indiana roads can range from requiring minor periodic maintenance to putting the road completely out of service. Periodic maintenance over time may become too costly and a permanent correction may be needed to repair the landslide. The first step to determine if a permanent correction is needed is to identify the landslide's movement.

Common evidence of landslide movement can include:

- head scarps
- toe budes
- pavement cracks
- hummocky terrain
- J-shaped trees and tilting trees or poles
- misalignment of guardrail
- failed drainage structures.

These conditions are described further and are pictured below. It should be noted that some of these conditions can occur, but will not represent slope instability. Typically, when a slope instability is occurring multiple characteristics are present.

All potential landslides should be reported to the Director of INDOT Geotechnical Services Division.



USGS Diagram of landslide, from United States Geological Survey Fact Sheet 3004-3072

### Head Scarp

The head is the upslope portion of the landslide. A scarp is a steep (nearly vertical) region of exposed soil and rock at the head of the landslide where the failure surface ruptures the ground surface. Head scarps can also be referred to as main scarps as shown in the USGS diagram in the introduction of this document.



Head scarp on SR 52  
Franklin County, Indiana

Likely head scarp on SR 62  
Perry County, Indiana





### **Toe Bulge**

The toe is the downslope portion of the landslide. The intersection between the lower part of the surface of rupture of a landslide and the original ground surface is the toe bulge. Toe bulges can fill in drainage ditches along roadways and even cause uplift in the roadway's pavement as seen in photo below.



Photo: Uplift in sidewalk on SR 111,  
Floyd County, Indiana



Photo: Uplift in pavement on SR 66 Spencer County, Indiana

### **Tension Crack**

Tension cracks are breaks in the ground surface which are found throughout the landslide mass. Types of tension cracks are represented on the USGS diagram in the introduction of this document.



US 52 Franklin County, Indiana



SR 145 Perry County, Indiana



### **Hummocky Terrain**

Hummocky terrain is where the slope is bumpy and uneven. Signs of hummocky terrain can include water puddles on the slope, uneven vegetation, grass appearing in large clumps, and oddly-placed boulders.



Hummocky/bumpy surface near SR 64  
Pike County, Indiana



Uneven ground near SR 63  
Vigo County, Indiana



### **J Shaped Trees, Tilting Trees or Poles**

If the slide has been a slow continuous movement, trees growing will compensate for the movement of their base, resembling a J-shape. Trees and poles may begin to tilt over time as the slide continues to move.



Trees leaning on US 52 Franklin County, Indiana



Pole leaning near SR 66 Perry County, Indiana



US 52 Franklin County, Indiana

### **Misalignment of Guardrail**

Landslides can cause a drop or a bend in the guardrail along the roadway.



Drop in guardrail on SR 66 Vanderburgh County, Indiana



Guardrail bending on SR 245  
Spencer County, Indiana

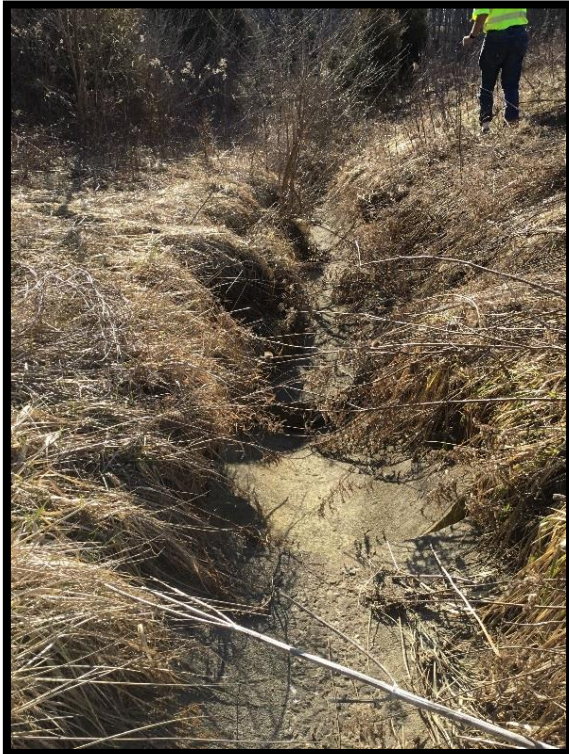


Guardrail bending and disappearing downslope on SR 1  
Franklin County, Indiana



### **Failure of Drainage Structures**

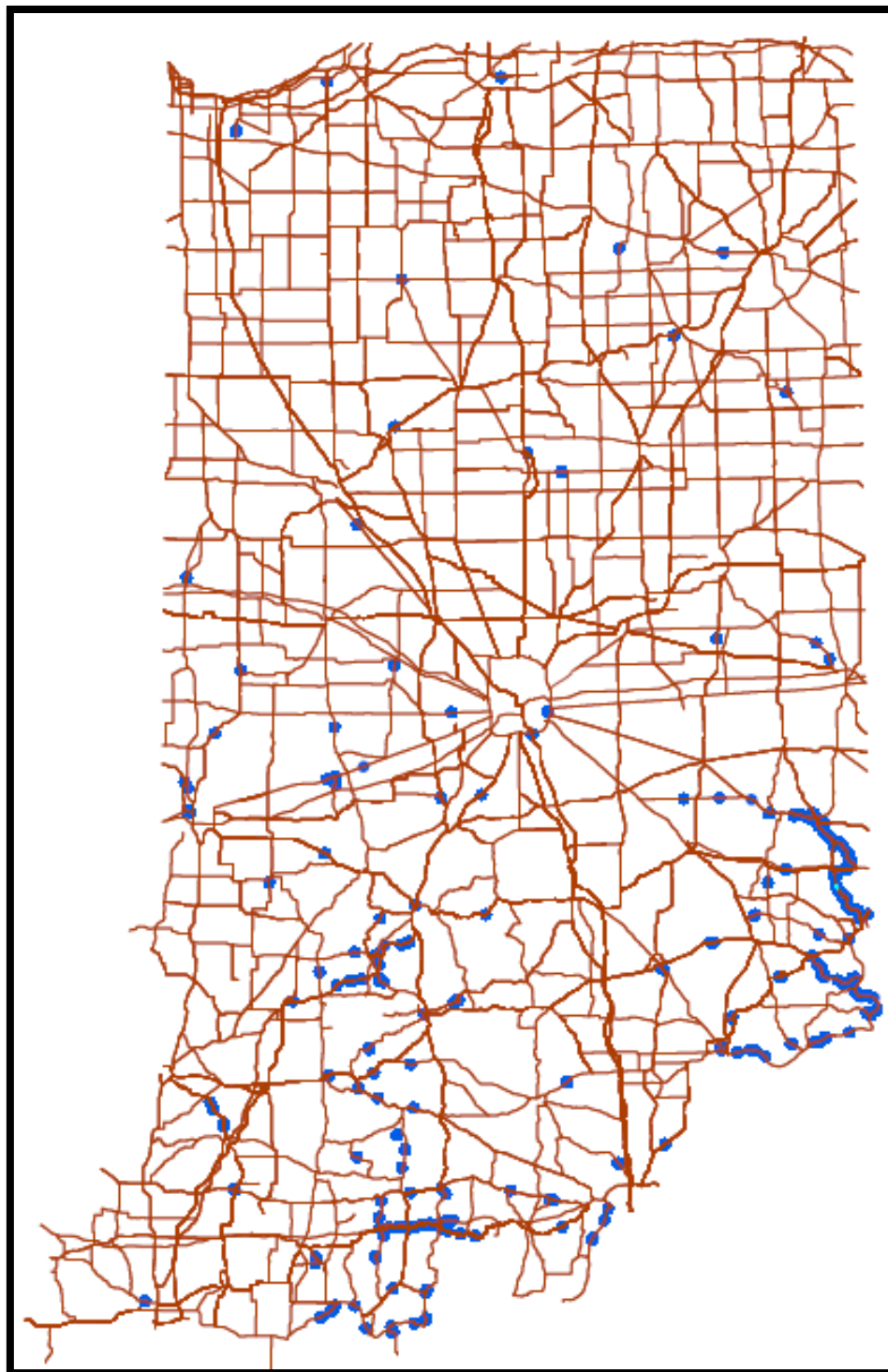
Landslides can cause separation of paved gutters or pipe sections depending on the type of slope movement.



Broken paved ditch near SR 350,  
Ripley County Indiana



Broken paved swale near SR 63  
Vigo County, Indiana



Landslide locations (blues areas). Data collected by INDOT Geotechnical Services.